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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Bailey III et al.

Attorney Docket No.: LAM1P123/P0557

Application No.: 09/470,236

Examiner: Alejandro Mulero, Luz L.

Filed: November 15, 1999

Group: 1763

Title: PLASMA PROCESSING SYSTEM WITH DYNAMIC GAS DISTRIBUTION CONTROL

Confirmation No. 5922

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the U.S. Postal Service with sufficient postage as first-class mail on September 11, 2006 in an envelope addressed to the Commissioner for Patents, Mail Stop Appeal Brief-Patents, P.O. Box 1450 Alexandria, VA 22313-1450.

Signed: Agnes Spence

Agnes Spence

APPEAL BRIEF TRANSMITTAL
(37 CFR 192)

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This brief is in furtherance of the Notice of Appeal filed in this case on June 9, 2006.

This application is on behalf of

☐ Small Entity ☒ Large Entity

Pursuant to 37 CFR 1.17(f), the fee for filing the Appeal Brief is:
☐ \$250.00 (Small Entity) ☒ \$500.00 (Large Entity)

☒ Applicant(s) hereby petition for a one extension(s) of time to under 37 CFR 1.136.

If an additional extension of time is required, please consider this a petition therefor.

☐ An extension for months has already been secured and the fee paid therefor of \$ is deducted from the total fee due for the total months of extension now requested.

☐ Applicant(s) believe that no (additional) Extension of Time is required; however, if it is determined that such an extension is required, Applicant(s) hereby petition that such an

extension be granted and authorize the Commissioner to charge the required fees for an Extension of Time under 37 CFR 1.136 to Deposit Account No. 500388.

Total Fee Due:	
Appeal Brief fee	$500.00
Extension Fee (if any)	$120.00
Total Fee Due	$620.00

☒ Enclosed is Check No. 31461 in the amount of $620.00.

☒ Charge any additional fees or credit any overpayment to Deposit Account No. 500388, (Order No. LAM1P123). Two copies of this transmittal are enclosed.

Respectfully submitted,
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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

EX PARTE BAILEY*et al.*

Application for Patent

Filed: November 15, 1999

Serial No. 09/470,236

FOR:

PLASMA PROCESSING SYSTEM WITH DYNAMIC GAS DISTRIBUTION CONTROL

APPEAL BRIEF

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(1) REAL PARTY IN INTEREST

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(2) RELATED APPEALS AND INTERFERENCES

No Related Appeals or Interferences

(3) STATUS OF CLAIMS

There are a total of 50 claims pending in this application (claims 1-10, 16-17, 19, 23-25, 28-33, 35-36, 42-45, 48, 50, 54 and 57-75). Claims 11-15, 18, 20-22, 26-27, 34, 37-41, 46-47, 4951-53, and 55-56 have been canceled. Claims 1-10, 16-17, 19, 23-25, 28-33, 35-36, 42-45, 48, 50, 54 and 57-75 were examined and rejected.

(4) STATUS OF AMENDMENTS

No amendment has been filed in response to the outstanding Office Action of March 9, 2006. All amendments previously filed have been entered.

(5) SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 1

Claim 1 describes a plasma processing system having two parts: a substantially cylindrical plasma processing chamber and a gas flow system coupled to the plasma processing chamber. This system is also described in detail in various places in the Specification, including FIG. 2 and the corresponding text on page 7, line 26 through page 11, line 25.

The plasma processing chamber is described as being configured for etching a semiconductor substrate. It is also described as having a top region located on the top surface of the substantially cylindrical plasma processing chamber, a peripheral region located on a side surface surrounding the periphery of the of the plasma processing chamber, and an inner wall. The plasma processing chamber is labeled as 202 in FIG. 2. The top region is the region of the chamber at or near the connection to outlet 226 and the peripheral region is the region of the chamber at or near the connection to outlet 228. More details about the top and peripheral regions can be found at page 8, line 29 through page 9, line 5.

The gas flow system is described as controlling flow of a single input gas comprising a mixture of etchant gases into at least two different regions of the plasma processing chamber. This gas flow system is labeled as 221 of FIG. 2 and described on page 8, lines 20-28. The gas flow system is further described as having a gas inlet for receiving the single input gas that is to be delivered into the plasma processing chamber and at least first and second gas outlets configured to deliver the same single input gas to at least two different regions including the peripheral region and top region of the plasma processing chamber. The gas inlet is labeled as 224 of FIG. 2 (and described on page 8, lines 20-28. The first and second gas outlets are labeled as 226 and 228 in FIG. 2. The configuration to deliver the same single input gas to the regions is described on page 9, lines 25-29.

The peripheral region is further described as not including any points of the top region of the plasma processing chamber. At least a first portion of the input gas is

delivered via the first outlet and the remaining portion via the second outlet such that the gases delivered to each region receive the same mixture of enchant gases. The gas flow system is then also configured to vary the amounts of the first and remaining portions in order to control the distribution of neutral gas components inside the plasma processing chamber thereby improving process uniformity. This is described on page 9, line 30 through page 10, line 12 and also on page 15, line 17 through page 16, line 3.

Independent claim 19

Claim 19 describes a plasma etcher for etching a substrate. This etcher includes a plasma processing chamber wherein a plasma is both ignited and sustained for an etching task, the plasma processing chamber having no separate plasma generation chamber but having an upper end and a lower end, the substrate being processed in the lower end. This etcher is also described in detail in various places in the Specification, including FIG. 2 and the corresponding text on page 7, line 26 through page 11, line 25.

The etcher further includes a gas flow system coupled to the plasma processing chamber. The gas flow system separates and directs the flow of the same single input gas, associated with forming a plasma, at the same time into at least two different regions of the plasma processing chamber. This gas flow system is labeled as 221 of FIG. 2 and described on page 8, lines 20-28. The at least two different regions include at least an upper peripheral region located at a side surface of the plasma processing chamber and at least a top central region located at a top surface of the plasma processing chamber, the upper peripheral region being located closer to the upper end of the plasma processing chamber than the lower end of the plasma processing chamber, at least a first portion of the input gas being delivered to the upper peripheral region and a remaining portion of the input gas being delivered to the top central region, the first portion and the remaining portion having the same composition of etchant source gases as the same single input gas since they are split therefrom. The upper peripheral region is located at a side surface of the plasma processing chamber, such as near the periphery of ring 230 in FIG. 2 as opposed to the top central region, which is located closer to the center of ring 230 in FIG. 2. The delivery of the same etchant gas to each of these regions via splitting from the same source is described on page 8, lines 20-28.

The etcher further includes an azimuthally symmetric gas distribution system comprising at least gas ring that supplies a portion of the single input gas to the upper peripheral region, the gas ring including a series of holes substantially equidistant about the periphery of the gas ring. This ring embodiment is described on page 9, lines 13-29.

Independent claim 50

Claim 50 describes a gas flow system for distributing gases within a plasma process chamber suitable for etching a semiconductor substrate. The gas flow system comprises: a gas source, plurality of outputs, and a gas flow controller disposed between the gas source and the plurality of outputs. This system is also described in detail in various places in the Specification, including FIG. 2 and the corresponding text on page 7, line 26 through page 11, line 25.

The gas source is capable of supplying an input gas associated with forming a plasma, the input gas comprising a mixture of etchant source gases. The gas source is described in the specification on page 8, lines 24-25 as a gas supply.

The plurality of outputs are for releasing the input gas formed by the mixture of etchant source gases into the plasma process chamber, a first output being configured to release the input gas into a top central region of the plasma process chamber, a second output being configured to release the input gas into an upper peripheral region of the plasma process chamber. These outputs are described in various places on page 7, line 26 through page 11, line 25. One example is outputs 226 and 228 in FIG. 2.

The gas flow controller is configured to control the delivery of the input gas into the plasma process chamber, the gas flow controller having an inlet arranged to receive the input gas from the gas source, and a plurality of outlets arranged to deliver the same the input gas to different locations within the plasma process chamber, a first outlet being configured to deliver the input gas to the first output, a second outlet being configured to deliver the input gas to the second output, the gas flow controller directing at the same time varying amounts of the same the input gas to each of the first and second outputs so as to provide better process control, a first portion of the total flow of the input gas being delivered through the first outlet to the first output, and a remaining portion of the total flow of the input gas being delivered through the second outlet to the second output, the first and second portions of the

input gas having the same mixture of etchant source gases as the input gas. The delivery of the same etchant gas to each of these regions via splitting from the same source is described on page 8, lines 20-28.

Independent claim 69

Claim 69 describes a plasma etcher having a process chamber and a gas flow system. This system is also described in detail in various places in the Specification, including FIG. 2 and the corresponding text on page 7, line 26 through page 11, line 25. An etching task is performed inside the process chamber, the process chamber including a top wall that defines a top region of the process chamber and a side wall that defines a side region of the process chamber, the top region being disposed above a substrate to be etched, the side region being disposed to the side of substrate to be etched.

The gas flow system is for delivering gas into the process chamber and comprises:

a single source of input gas, the input gas comprising a mixture of etchant source gases;

a gas flow controller for adjusting the amounts and splitting the input gas into at least a first portion and a remaining portion, each portion having the same mixture of etchant source gases because the gas is split; and

a plurality of gas conduits that directly couple the gas flow controller to a plurality of gas outlets located at different regions of the process chamber, a first gas conduit delivering the first portion of the input gas to a first gas outlet, a second gas conduit delivering the remaining portion of the input gas to a second gas outlet, the mixture of etchant source gases remaining the same while traveling through the first and second conduits from the gas flow controller to the first and second gas outlets such that the same mixture of etchant source gases is outputted by the first and second gas outlets into the process chamber, the first gas outlet outputting the first portion of input gas into the top region of the process chamber, the second gas outlet outputting the remaining portion of input gas into the side region of the process chamber,

wherein the gas flow controller is configured to adjust the gas flow rates of the first and remaining portions in order to control the distribution of neutral plasma

components inside the process chamber thereby improving the results of the etching task that is being performed inside the process chamber.

The conduits are described in various places on page 7, line 26 through page 11, line 25. One example is outputs 226 and 228 in FIG. 2. The delivery of the same etchant gas to each of these regions via splitting from the same source is described on page 8, lines 20-28.

Independent claim 70

Claim 70 describes a plasma etcher, having a process chamber and a gas input means. A plasma is generated for etching a semiconductor substrate inside the process chamber, the process chamber including an upper region and a lower region, the plasma including both charged and neutral components. The charged and neutral components are described in the Specification on page 13, line 29 through page 14, line 13.

The gas input means is configured to deliver a single input gas comprising a mixture of etchant source gases to different locations of the process chamber in order to control the distribution of neutral components inside the process chamber, the gas input means adjusting the time that the neutral components spend in different zones of the process chamber by varying the amount of input gas that is delivered to the different locations of the process chamber, the different zones of the process chamber including at least a hot zone where the input gases are excited, the different locations of the process chamber including at least the upper and lower regions of the process chamber. This is also described on the Specification on page 13, line 29 through page 13, line 13.

(6) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 63 and 69 have been rejected under 35 U.S.C. § 112 as failing to comply with the written description requirement.

<u>The rejection of each of claims 63 and 69 under § 112 is appealed.</u>

Claims 1, 3, 7-10, 16-17, 70-71, and 75 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 6,009,830 issued to Li et al. (hereinafter "Li") in view of Fujii et al., US Patent No. 4,980,204 (hereinafter "Fujii") or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810.

Claims 1-5, 7-10, 16-17, 50, 57, 59, 62, 67-68, 70-71, and 75 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Li et al., US Patent No. 6,070,551 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810.

Claim 6 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Li et al., US Patent No. 6,070,551 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-10, 16-17, 50, 57, 59, 62, 67-68, 70-71, and 75, and further in view of Wing et al., US Patent No. 6,277,235.

Claims 58, 60-61, and 63-65 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Li et al., US Patent No. 6,070,551 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-10, 16-17, 50, 57, 59, 62, 67-68, 70-71, and 75, and further in view of Li et al., US Patent No. 6,009,830.

Claims 1-5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50, 54, 66-68, 70-73, and 75 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Collins et al., US Patent No. 6,024,826 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810.

Claims 6 and 36 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Collins et al., US Patent No. 6,024,826 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50, 54, 66-68, 70-73, and 75, and further in view of Wing et al., US Patent No. 6,277,235.

Claims 10 and 57-65 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Collins et al., US Patent No. 6,024,826 in view of Fujii et al., US

Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50, 54, 66-68, 70-73, and 75, and further in view of Li et al., US Patent No. 6,070,551.

Claims 45 and 74 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Collins et al., US Patent No. 6,024,826 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50, 54, 66-68, 70-73, and 75, and further in view of Ueda et al., US Patent No. 5,810,932 and Kadomura, US Patent No. 6,096,160.

Claims 1-5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 54, 57, 59, 62, 66, 70-72, and 75 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Murugesh et al., US Patent No. 6,228,781 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810.

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Claims 58 and 60-61 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Murugesh et al., US Patent No. 6,228,781 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42-

44, 48, 54, 57, 59, 62, 66, 70-72, and 75, and further in view of Li et al., US Patent No. 6,009,830.

The rejection of each of claims 1-10, 16-17, 19, 23-25, 28-33, 35-36, 42-45, 48, 50, 54, and 57-75 under 35 U.S.C. § 103(a) is appealed.

(7) ARGUMENT

Rejection of claims 63 and 69 under 35 U.S.C. § 112

The Final Office Action argues:

> In the specification, as originally filed, there is no support for the limitation "the gas distribution plate and the gas ring cooperating to release the identical input gas in an azimuthally symmetric manner inside the plasma process chamber" as disclosed in claim 63, lines 4-5. There is nothing in the specification to indicate that the gases will have exactly or identical compositions. Furthermore, the specification, as originally filed, fails to find support for the limitation 'a single source of input gas' as recited in claim 69-line 8. It appears from fig. 2 that more than one gas source is contemplated

Final Office Action, page 2. These elements, however, are described in the Specification and shown in FIG. 2. Specifically, regarding the Office Action's contention that there is nothing in the specification to indicate that the gases will have exactly or identical compositions, page 8, lines 25-28 states that the "source gas can be a single gas or a mixture of gases. The gas flow controller also includes outlets 226 and 228 that supply the source gas to different locations of the plasma processing chamber 202 in a controlled fashion." Since an embodiment is described wherein the source gas is a single gas, and this single gas is supplied to different locations of the plasma processing chamber, there is support for the idea that the identical input gas is released in an azimuthally symmetric manner inside the plasma process chamber. As to the alleged lack of support for a single source of input gas, the section of the specification described above also applies here - the single source gas comes from a single source. The Office

Action's description of FIG. 2 as allegedly showing multiple gas sources is confusing as the gas flow controller 222 clearly has only one gas input 224. The Examiner may be confusing the control signal 236 for a gas input, but that is obviously incorrect. As such, the Applicant respectfully submits that the 35 U.S.C. § 112 rejection is in error.

Rejection of claims 1-10, 16-17, 19, 23-25, 28-33, 35-36, 42-45, 48, 50, 54, and 57-75 under 35 U.S.C. § 103(a)

Summary:

There are three main issues with regard to the 35 U.S.C. § 103 rejection.

1. The Final Office Action fails to address a current version of the claims.
2. Several of the prior art references teach deposition chambers, not etch chambers, and these references are combined with references teaching etch chambers without a motivation to combine such disparate references.
3. Many of the prior art references fail to teach various elements of the claims.

1. The Final Office Action fails to address a current version of the claims.

Pages 3-7 of the Final Office Action describe the rejection of claims 1, 3, 7-10, 16-17, 70-71, and 75 under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 6,009,830 issued to Li et al. (hereinafter "Li") in view of Fujii et al., US Patent No. 4,980,204 (hereinafter "Fujii") or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810. Pages 7-12 of the Final Office Action describe the rejection of claims 1-5, 7-10, 16-17, 50, 57, 59, 62, 67-68, 70-71, and 75 under 35 U.S.C. § 103(a) as being unpatentable over Li et al., US Patent No. 6,070,551 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810. Neither of these rejections apply the prior art to the current set of claims.

For example, page 3 states that "Li et al. shows substantially the invention as claimed including a plasma processing system, said plasma processing system comprising: a substantially cylindrical plasma processing chamber 8 used to process a substrate 10...." This element, however, is from an older version of claim 1. The current version of claim 1 states "a substantially cylindrical plasma processing chamber configured for etching a semiconductor substrate." This is an important distinction, as the cited prior art fails to teach a chamber configured for etching a semiconductor substrate, and thus fails to teach each element of the claims, as described in more detail below.

Likewise, the Final Office Action fails to address, for example, the "plasma etcher" element of claims 19, 69, and 70 or the "gas flow system for distributing gases within a plasma process chamber suitable for etching a semiconductor substrate" of claim 50. Other examples of failing to address the current set of claims can be found throughout the Final Office Action.

By failing to address the current set of claims, the Final Office Action fails to make a prima facie case for unpatentability.

2. <u>Several of the prior art references teach deposition chambers, not etch chambers, and these references are combined with references teaching etch chambers without a motivation to combine such disparate references.</u>

Several of the prior art documents (e.g., Li (551), Muregesh, Fujii, Yamazaki, Fujiyama) used to reject various claims teach deposition chambers, while other prior art documents teach etch chambers. The Examiner has failed to provide any justification why one of ordinary skill in the art would find it obvious to combine elements from a deposition chamber into an etch chamber. Specifically, the design of deposition chambers are different than etch chambers because of the disparate requirements of the two types of chambers. Deposition gases are known to be highly reactive on the wafer and hence of critical importance by themselves on the resulting performance of the deposition process. This is why it the prior art teaches gas mixtures introduced at different locations in the deposition chamber. However, the taking of this design and utilizing it in an etch chamber is not obvious, because the usefulness of having the same

gas applied to different regions of the chamber is not something that one thinks for purposes of etching. Indeed, the lack of sensitivity of device geometries in etch chambers and resulting etch profiles and rates to variations in gas flows relative to variations in plasma controlling parameters such as pressure and rf power made such a modification unthinkable in the past. The low pressures used for plasma etch form plasma gas mixtures that do not interact strongly with the wafer or chamber walls, hence the neutral gases bounce all over the chamber to equalize the pressure near instantaneously from wherever it is introduced in the chamber. Thus, the plasma resulting from the various flow ratios in the present invention are nearly identical and yet process uniformity can still be maintained. In contrast, the conventional wisdom in the prior art was that it really didn't matter where you introduced the mixture, but rather how and where power was supplied into the plasma and how these charged and excited species diffused to the wafer. This was especially true in plasma etch systems where the electrical forces on the charged species that were most involved in driving the etch process results were a much stronger influence on the uniformity of the plasma (and hence the plasma etch results) than the neutral dynamics. This concern is evidenced in the antenna design, magnetic uniformity control, and plasma density control patents that are incorporated by reference into the present applications. It was the inventors' realization that for advanced etch uniformity control, both electromagnetic control of the plasma as well as the addition of subtle gas distribution control would be required.

Given the disparate needs and designs of etch chambers and deposition chambers, it is necessary for there to be motivation to combine an element from a prior art deposition chamber with a prior art etch chamber. The PTO has failed to provide such a motivation. Indeed, when presented with the argument that a motivation to combine must be provided, the Final Office Action indicated that the fact that the present invention is directed to an etch chamber is essentially irrelevant. Specifically, the Final Office Action states:

> Concerning the fact that some of the reference show deposition processes while many of the claims require etching, note that this limitation is directed to a method limitation instead of an apparatus limitation and since an apparatus is being claimed as the instant invention, the method teachings are not considered to be the matter at hand, since a variety of methods can be done with the apparatus.

> The method limitations are viewed as intended uses that do not further limit, and therefore do not patentably distinguish the claimed invention.

Final Office Action, page 30. The Applicant respectfully disagrees for two reasons. First of all, the etch-related limitations are in fact apparatus limitations, not method limitations. Claim 1 recites a "substantially cylindrical plasma processing chamber configured for etching a semiconductor substrate." This is a structural limitation that requires that the structure of the chamber be capable of etching a semiconductor substrate. Claim 50 describes a "plasma process chamber suitable for etching a semiconductor substrate. Claims 19, 69, and 70 go even further, describing an "etcher", which is clearly a structure. In other places, gases are described as being "etchant gases." These are structural limitations of the claims and cannot simply be ignored as the PTO is attempting.

Second of all, regardless of the claim language, there still must be a motivation to combine references used in a 35 U.S.C. § 103 rejection. As stated in M.P.E.P. 2141 (II), the references used in a 35 U.S.C. § 103 rejection must be considered as a whole. In the present case, the PTO consistently ignores this tenet and instead argues that it is obvious to combine elements from a deposition chamber into an etch chamber without any regard for the differences between deposition chambers and etch chambers and the different motivations of designers of the disparate chambers. For example, claim 1 is rejected based on Li (830) in view of Fujii, Fujiyama, or Yamazaki. Li (830), however, is directed at an etch chamber while Fujii, Fujiyama, and Yamazaki are directed at deposition chambers. Given the vastly different natures of the underlying devices, there needs to be some motivation to combine that takes into account these very different natures. As a metaphor, an airplane may have wings, an altimeter, and a rudder, but it would not ordinarily be obvious to modify a bicycle to have wings, an altimeter, and a rudder. While it may be possible that in certain instances some elements from an airplane would be obvious to place in a bicycle, any such rejection would require a motivation to be stated that takes into account the fact that one device is an airplane and another is a bicycle. It is not permissible to simply ignore the underlying natures of the devices as the PTO is attempting to do. Any stated motivation to combine these disparate prior art references must take into account the references as a whole.

As such, Applicant respectfully submits that no prima facie case for obviousness has been made.

3. Many of the prior art references fail to teach various elements of the claims.

The present invention is part of a group of applications (all of which are incorporated by reference) directed at azimuthally symmetric processing. It is believed that azimuthally symmetric processing provides better control and more uniform processing at the surface of the substrate. With regard to the present invention described herein, a gas flow system is configured to carry and distribute the same gas mixture (from the same source) to different outlets, and to control the amount of gas through each of the outlets. The invention allows a set single gas mixture with a single sum total flow (sccm) to be split or rationized to multiple portions of the chamber. By rationizing the gas at different regions, the gas may be distributed more evenly inside the process chamber (which as a result can produce more uniform results across the surface of the substrate). Furthermore, the gas mixture being delivered to each region is the same (e.g., from the same source) thereby reducing variations caused by delivering a different gas mixture to each of the regions. It should be noted that even if two independent gas supplies used the same recipe to produce the same gas mixture, there would be differences in the outputted gas mixture (different independent gas sources cannot make exactly the same gas). These differences lead to process variations. Further still, the gas being delivered to each region is symmetrically distributed in each region. For example, a gas ring having a series of holes substantially equidistant about the periphery of the ring or a gas distribution plate with symmetrically patterned holes can be used.

This is not the case in the cited references. In the cited references, different gases are fed individually into different portions of the chamber and in some cases the gases are only fed into one region of the chamber. As a result, process variations may be produced during processing. Furthermore, their systems are much more complex and likely to send to much gas (or are actually set to prevent the ability to send to) a single gas outlet. Their systems are set to prevent mixing or they have independent controls so their gas mixture

setting MFCs are all driven independently with reasonable pressure drops across them. If they put all their flows together, their MFCs would have very little pressure drop across them and fail to control and hence lead to failure to control the mixture of the total flow. Moreover, the references do not describe azimuthally symmetric distribution of gases.

With regards to the primary references, *Li* (6070551) feeds multiple gases individually and is all about being able to deliver different mixtures. In contrast, the present invention feeds a single mixture thereby always ensuring the same mixture is fed to the different regions. *Muregesh* (6228781) is all about delivering different gases, purging, managing cleaning, etc. They have many flow controllers 35A-A', 35B-B', etc. that go to multiple areas thereby making it very difficult to perform key element of the present invention, i.e., adjusting the gas ratio with a sure identical single mixture. *Collins* (6024826) teaches seven independent gas supplies, which is very complex and difficult to control. In contrast, the present invention feeds a single mixture thereby always ensuring the same mixture is fed to the different regions. In addition, *Collins* does not teach rationing to different regions. *Li* (6009830) mixes gas inside delivery lines and needs to set individual flows into the delivery lines to set ratio. Mixture and sub-total flow set by 68/72 goes to 56-54 while user must independently specify another mixture and total flow set by 70/74 going to 52/38 to ensure ratio of same mix with sum total gas delivered. In contrast, the present invention makes it easy to use a standard gas box with a bunch of MFCs to set a single gas mixture with a single sum total flow (sccm) that is then split by setting a single ratio to two different portions of the chamber.

With regard to the secondary references, *Fujii* does not deliver the same gas to two different regions. *Fujii* only delivers gas to a top region. Furthermore, the pipes are not azimuthally symmetric, but rather inline (see Fig. 7). *Fujiyama* discloses gas emitting tube 4 and gas emitting ring 9 that emit different gases at different times and thus the flow of a single gas is not controlled or rationized to two different regions. *Yamakazi* does not deliver gas to two different regions, and further does not control or rationize the exiting gases. In all three references, azimuthal symmetry is not described.

The remaining discussion is directed at independent claims 1, 19 and 50. It should be appreciated that similar arguments can be made against the rejections to the other independent claims 69 and 70.

Claim 1

In contrast to *Li*(830), *Li (551), Collins, Muregesh, Fujii, Fujiyama , Yamakazi* claim 1 (and its dependents) specifically requires, " said gas flow system controlling flow of a single input gas comprising a mixture of etchant source gases into at least two different regions of said plasma processing chamber....at least a first portion of said input gas being delivered to said plasma processing chamber via said first outlet and a remaining portion of said input gas being delivered to said plasma processing chamber via said second outlet." The primary references *Li (830), Li (551), Collins, Muregesh* do not disclose this limitation thus the Examiner relies on support from the other references *Fujji, Fujiyama and Yamakazi*. These references, however, also fail to teach or suggest such a limitation.

In *Fujii*, the four vent pipes 111-114 are only located at the top of the reactor chamber 5 and thus gases are not delivered to two different regions. That is, they only deliver to a top region. It should be pointed out that as further required by claim 1 the two different regions include at least a peripheral region and a top region. A peripheral region is simply not taught in *Fujii*. In *Fujiyama,* the gas emitting tube 4 and gas emitting ring 9 emit different gases and thus the flow of a single gas is not controlled to two different regions. As stated in *Fujiyama*, "silane gas from a starting gas tank 7 is emitted through a starting gas emitting tube 4 into the reaction chamber (Col. 2, lines 43-45)...a gas mixture of carbon tetrafluoride and oxygen in gas mixture container 8 is introduced into the reaction chamber through an etching gas emitting ring 9 (Col. 2, lines 59-63)." Furthermore, it should be noted that the emission of these two different gases is performed at different times and thus it cannot be the same gas. One is associated with a starting gas feeding system and the other is associated with an etching gas feeding system. In *Yamakazi,* the gases are only introduced at a top region as shown by Fig. 1 and thus gases are not delivered to two different regions. See *Fujii* above. It should further be pointed out that the exiting gases are not controlled and thus they are not rationized as further required by the claim.

Claim 19

In contrast to *Li, Collins, Muregesh, Fujii, Fujiyama , Yamakazi*, claim 19 (and its dependents) specifically requires, "...said gas flow system separating and directing the

flow of the same single input gas, associated with forming a plasma, at the same time into at least two different regions of said plasma processing chamber, said at least two different regions ... at least a first portion of said input gas being delivered to said upper peripheral region and a remaining portion of said input gas being delivered to said top central region..." As mentioned by the Examiner, *Collins, Muregesh* do not disclose this limitation thus relying on support from the other references *Fujji, Fujiyama and Yamakazi*. These references, however, also fail to teach or suggest such a limitation (see above).

Claim 50

In contrast to *Li (551), Collins, Muregesh, Fujii, Fujiyama , Yamakazi*, claim 50 (and its dependents) specifically requires, "...a plurality of outlets arranged to deliver the same said input gas to different locations within said plasma process chamber, a first outlet being configured to deliver said input gas to said first output, a second outlet being configured to deliver said input gas to said second output, said gas flow controller directing at the same time varying amounts of said input gas to each of said first and second outputs so as to provide better process control, a first portion of the total flow of the input gas being delivered through the first outlet to the first output, and a remaining portion of the total flow of the input gas being delivered through the second outlet to the second output."

In the primary references *Li (551)*, *Collins*, and *Muregesh*, different gases (NOT the same gas as required by the claim) are fed individually into different portions of the chamber. This allows an operator to deliver different mixtures into the process chamber. For example, see Col. 5, lines14-27 in *Li* (551) where it is stated that states supplying different gases from different sources. Furthermore, as shown in the various Figures of *Collins* as for example Fig. 8, *Collins* shows seven independent gas supplies. Although the independent gas supplies may supply similar gases they do not deliver the same gas since they are independent of one another. Furthermore, *Collins* also fails to teach or suggest rationing to different regions. That is, *Collins* does not teach adjusting the amount of the input gas that is delivered to each of said first and second outputs.

Again, it should be emphasized that the present invention simultaneously feeds a single mixture to different regions of the process chamber. As a result, the same mixture

is always being delivered to the different regions. The total gas flow at the inlet is equal to the sum of the gas flow at the outlets. This is simply not done in *Li (551)*, *Collins*, and *Muregesh.*

Fujii, Fujiyama and Yamaguchi do not overcome the deficiencies of the primary references *Li, Collins and Muregesh.* In *Fujii*, the four vent pipes 111-114 are only located at the top of the reactor chamber 5 and thus gases are not delivered to two different regions. In *Fujiyama,* the gas emitting tube 4 and gas emitting ring 9 emit different gases and thus the flow of a single gas is not controlled to two different regions. In *Yamakazi,* the gases are only introduced at a top region and the exiting gases are not controlled and thus they are not rationized.

With regards to all the claims mentioned above, the remaining references of *Wing, Ueda, and Kadomura*, which are used to reject dependent claims do not overcome their deficiencies. That is, the also fail to teach or suggest the limitations of the independent claims.

Conclusion

In view of the foregoing, it is respectfully submitted that none of the pending claims are rendered unpatentable by the cited references. Accordingly, the pending rejections of all of the claims under 35 U.S.C. § 112 and 103 should be reversed.

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(8) CLAIMS APPENDIX

APPENDIX
PENDING CLAIMS

1. (Previously Presented) A plasma processing system, said plasma processing system comprising:

a substantially cylindrical plasma processing chamber configured for etching a semiconductor substrate, said substantially cylindrical plasma processing chamber including a top region located on the top surface of said substantially cylindrical plasma processing chamber and a peripheral region located on a side surface surrounding the periphery of said substantially cylindrical plasma processing chamber, said substantially cylindrical plasma processing chamber including at least an inner wall; and

a gas flow system coupled to said plasma processing chamber, said gas flow system controlling flow of a single input gas comprising a mixture of etchant source gases into at least two different regions of said plasma processing chamber, said gas flow system comprising a gas inlet for receiving said single input gas that is to be delivered into said plasma processing chamber and at least first and second gas outlets configured to deliver the same said single input gas to at least two different regions including at least one peripheral region and at least one top region of said plasma processing chamber, said peripheral region of said plasma processing chamber not including any points of said top region of said plasma processing chamber, at least a first portion of said input gas being delivered to said plasma processing chamber via said first outlet and a remaining portion of said input gas being delivered to said plasma processing chamber via said second outlet, the first portion and the remaining portion of said input gas having the same mixture of etchant source gases so that said at least two different regions receive the same mixture of etchant source gases, the gas flow system being configured to vary the amounts of first and remaining portions in order to control the distribution of neutral gas components inside the plasma processing chamber thereby improving process uniformity.

2. (Original) A plasma processing system as recited in claim 1, wherein the at least two different regions include a top central region and an upper peripheral region.

3. (Original) A plasma processing system as recited in claim 1, wherein the at least two different regions include a top central region and a lower peripheral region.

4. (Original) A plasma processing system as recited in claim 1, wherein the at least two different regions include a top central region, a lower peripheral region, and an upper peripheral region.

5. (Previously Presented) A plasma processing system as recited in claim 2, wherein the at least two different regions further include a lower region near the substrate.

6. (Previously Presented) A plasma processing system as recited in claim 5, wherein the plasma processing system includes a chuck and

wherein the input gas is released through the chuck in order to deliver a second portion of the input gas to the lower region.

7. (Original) A plasma processing system as recited in claim 1, wherein said flow system controls amount or volume of the input gas into the at least two different regions of said plasma processing chamber.

8. (Original) A plasma processing system as recited in claim 1, wherein said flow system controls flow rate of the input gas into the at least two different regions of said plasma processing chamber.

9. (Previously Presented) A plasma processing system as recited in claim 1, wherein the input gas includes at least first and second gases, and

wherein said flow system independently controls relative flow rate of the same input gas into the at least two different regions of said plasma processing chamber.

10. (Previously Presented) A plasma processing system as recited in claim 1,

wherein said plasma processing system further comprises a gas delivery ring that is fluidly coupled to said first outlet, and positioned on an upper portion of the plasma processing chamber, the gas delivery ring including a series of holes substantially equidistant about the periphery of the gas delivery ring, the first portion of said input gas being delivered into said peripheral region of said plasma processing chamber through said series of holes.

11. (Cancelled)

12. (Cancelled)

13. (Cancelled)

14. (Cancelled)

15. (Cancelled)

16. (Previously Presented) A plasma processing system as recited in claim 1, wherein the gas flow system receives a gas flow control signal for determining the amount or volume of the input gas that is delivered into the plasma processing chamber by each one of the first and second gas outlets.

17. (Original) A plasma processing system as recited in claim 16, wherein the gas flow control signal determines the flow rate of delivery of gas by each of the first and second gas outlets into the plasma processing chamber.

18. (Cancelled)

19. (Previously Presented) A plasma etcher for etching a substrate, comprising:

a plasma processing chamber within which a plasma is both ignited and sustained for an etching task, said plasma processing chamber having no separate plasma

generation chamber, said plasma processing chamber having an upper end and a lower end, said substrate being processed in said lower end;

a gas flow system coupled to said plasma processing chamber, said gas flow system separating and directing the flow of the same single input gas, associated with forming a plasma, at the same time into at least two different regions of said plasma processing chamber, said at least two different regions including at least an upper peripheral region located at a side surface of said plasma processing chamber and at least a top central region located at a top surface of said plasma processing chamber, said upper peripheral region being located closer to said upper end of said plasma processing chamber than said lower end of said plasma processing chamber, at least a first portion of said input gas being delivered to said upper peripheral region and a remaining portion of said input gas being delivered to said top central region, the first portion and the remaining portion having the same composition of etchant source gases as the same single input gas since they are split therefrom; and

an azimuthally symmetric gas distribution system comprising at least gas ring that supplies a portion of said single input gas to the upper peripheral region, the gas ring including a series of holes substantially equidistant about the periphery of the gas ring.

20. (Cancelled)

21. (Cancelled)

22. (Cancelled)

23. (Original) A plasma processing system as recited in claim 19, wherein said flow system controls amount or volume of the input gas into the at least two different regions of said plasma processing chamber.

24. (Original) A plasma processing system as recited in claim 19, wherein said flow system controls flow rate of the input gas into the at least two different regions of said plasma processing chamber.

25. (Previously Presented) A plasma processing system as recited in claim 19, wherein the single input gas includes at least first and second gases, and

wherein said flow system independently controls relative flow rate of the same single input gas including the first and second gases into the at least two different regions of said plasma processing chamber.

26. (Cancelled)

27. (Cancelled)

28. (Previously Presented) A plasma processing system as recited in claim 19, wherein said plasma processing chamber includes at least an inner wall, and the gas flow system comprises:

at least one gas inlet for receiving the input gas that is to be flown into said plasma processing chamber;

at least first and second gas outlets that are each capable of delivering the input gas to the plasma processing system; and

wherein a first portion of the input gas is delivered to the plasma processing chamber via said first gas outlets and wherein a remaining portion of the input gas is delivered to the plasma processing chamber via said second gas outlet.

29. (Previously Presented) A plasma processing system as recited in claim 28, wherein the azimuthally symmetric gas distribution system further includes a gas distribution plate that supplies a portion of said single input gas to the top central region, the gas distribution plate having a pattern of holes, the gas ring being fluidly coupled to the first gas outlet and the gas distribution plate being fluidly coupled to the second gas outlet and wherein a first portion of the input gas is released into the upper peripheral region through the gas ring, and

wherein the remaining portion of the input gas is released into the top central region through the gas distribution plate.

30. (Original) A plasma processing system as recited in claim 28, wherein the at least a portion of the input gas is released into a second region, the first region being an upper peripheral region that surrounds the inner wall of the plasma processing chamber, and the input gas that is released into the second region is delivered by the second gas outlet.

31. (Original) A plasma processing system as recited in claim 28, wherein the at least a portion of the input gas is released into a second region, the second region being a lower peripheral region that surrounds the inner wall of the plasma processing chamber, and the input gas that is released into the second region is delivered by the second gas outlet.

32. (Original) A plasma processing system as recited in claim 28, wherein the gas flow system receives a gas flow control signal for determining the amount or volume of the input gas that is delivered into the plasma processing chamber by each one of the first and second gas outlets.

33. (Original) A plasma processing system as recited in claim 32, wherein the gas flow control signal determines the flow rate of delivery of gas by each of the first and second gas outlets into the plasma processing chamber.

34. (Cancelled)

35. (Previously Presented) A plasma processing system as recited in claim 19, wherein the at least two different regions further include a lower region near the substrate.

36. (Previously Presented) A plasma processing system as recited in claim 19, wherein the lower region is located on a chuck near the edges of the substrate, at least a first portion of said input gas being delivered to said upper peripheral region, a second portion of said

input gas being delivered to said lower region through said chuck and a remaining portion of said input gas being delivered to said top central region.

37. (Cancelled)

38. (Cancelled)

39. (Cancelled)

40. (Cancelled)

41. (Cancelled)

42. (Previously Presented) A plasma processing system as recited in claim 19 wherein said input gas comprises a mixture of gases that are mixed before separating and directing the flow of the same single input gas at the same time into the at least two different regions of said plasma processing chamber.

43. (Previously Presented) A plasma processing system as recited in claim 19 wherein said top surface defines said upper end of said plasma processing chamber and wherein said peripheral region is located proximate to said upper end of said plasma process chamber.

44. (Previously Presented) A plasma processing system as recited in claim 19 further comprising:

a coupling window disposed at an upper end of said plasma processing chamber; and

an RF antenna arrangement disposed above a plane defined by said substrate when said substrate is disposed within said plasma processing chamber for said processing.

45. (Previously Presented) A plasma processing system as recited in claim 19 further comprising:

an electromagnet arrangement disposed above said plane defined by said substrate, said electromagnet arrangement being configured so as to result in a radial variation in the static magnetic field topology within said plasma processing chamber in the region proximate said RF antenna when at least one direct current is supplied to said electromagnet arrangement, said radial variation being effective to affect processing uniformity across said substrate; and

a dc power supply coupled to said electromagnet arrangement, said dc power supply having a controller to vary a magnitude of said at least one direct current, thereby changing said radial variation in said magnetic field topology within said plasma processing chamber in said region proximate said antenna to improve said processing uniformity across said substrate.

46. (Cancelled)

47. (Cancelled)

48. (Previously Presented) A plasma processing system as recited in claim 19 wherein said different regions further include a lower peripheral region located on a lower side surface of said plasma processing chamber, said lower peripheral region being located closer to said lower end of said plasma processing chamber than said upper end of said plasma processing chamber, at least a first portion of said input gas being delivered to said upper peripheral region, a second portion of said input gas being delivered to said lower peripheral region and a remaining portion of said input gas being delivered to said top central region.

49. (Cancelled).

50. (Previously Presented) A gas flow system for distributing gases within a plasma process chamber suitable for etching a semiconductor substrate, the gas flow system comprising:

a gas source capable of supplying an input gas associated with forming a plasma, the input gas comprising a mixture of etchant source gases;

a plurality of outputs for releasing said input gas formed by said mixture of etchant source gases into said plasma process chamber, a first output being configured to release said input gas into a top central region of said plasma process chamber, a second output being configured to release said input gas into an upper peripheral region of said plasma process chamber; and

a gas flow controller disposed between said gas source and said plurality of outputs, said gas flow controller being configured to control the delivery of said input gas into said plasma process chamber, said gas flow controller having an inlet arranged to receive said input gas from said gas source, and a plurality of outlets arranged to deliver the same said input gas to different locations within said plasma process chamber, a first outlet being configured to deliver said input gas to said first output, a second outlet being configured to deliver said input gas to said second output, said gas flow controller directing at the same time varying amounts of the same said input gas to each of said first and second outputs so as to provide better process control, a first portion of the total flow of said input gas being delivered through the first outlet to the first output, and a remaining portion of the total flow of the said input gas being delivered through the second outlet to the second output, the first and second portions of said input gas having the same mixture of etchant source gases as said input gas.

51. (Cancelled)

52. (Cancelled)

53. (Cancelled)

54. (Previously Presented) A plasma processing system as recited in claim 19 wherein said peripheral region is located closer to said top surface than said substrate when said substrate is disposed inside said plasma processing chamber for processing.

55. (Cancelled)

56. (Cancelled)

57. (Previously Presented) A plasma processing system as recited in claim 2, further comprising:

an azimuthally symmetric gas distribution system comprising a gas channel housing and a gas delivery ring positioned around the periphery of the process chamber and cooperating to supply the first portion of said input gas to the upper peripheral region, the gas channel housing including a gas channel operatively coupled to the first gas outlet and extending around the periphery of the gas channel housing, the gas delivery ring including a series of holes substantially equidistant about the periphery of the gas delivery ring, the holes providing openings between the gas channel and the upper internal areas of the process chamber, the first gas outlet supplying said first portion of said input gas to the gas channel, the gas channel equally distributing the first portion of said input gas through each of the holes in the gas delivery ring, and the holes feeding the first portion of said input gas into the upper peripheral region of the process chamber.

58. (Previously Presented) A plasma processing system as recited in claim 57, wherein the azimuthally symmetric gas distribution system further includes a gas distribution plate that supplies the remaining portion of said single input gas to the top central region, the gas distribution plate having a pattern of holes, the gas distribution plate being fluidly coupled to the second gas outlet.

59. (Previously Presented) A plasma processing system as recited in claim 57, wherein gas delivery ring includes 16 holes configured an equal distance from each other.

60. (Previously Presented) A plasma processing system as recited in claim 2, further comprising:

a vacuum plate positioned above the inner wall of the plasma processing chamber, the vacuum plate cooperating with the plasma processing chamber to form a processing region above the substrate, the vacuum plate including an opening at its center, the opening in the vacuum plate being fluidly coupled to the second outlet; and

a gas delivery ring provided between the vacuum plate and an upper surface of the inner wall, the gas delivery ring having a series of holes substantially equidistant about the periphery of the gas delivery ring, the series of holes being fluidly coupled to the first outlet, and being placed near the vacuum plate, and

wherein the first portion of the input gas is supplied to the upper peripheral region of the plasma processing chamber via the holes in the gas delivery ring, and wherein the remaining portion of the input gas is supplied to the top central region of the plasma processing chamber via the opening in the vacuum plate.

61. (Previously Presented) A plasma processing system as recited in claim 59, wherein a seal is provided between the gas delivery ring and the vacuum plate and between the upper surface of the inner walls and the gas delivery ring.

62. (Previously Presented) A plasma processing system as recited in claim 1, wherein the top region is located directly above the substrate to be processed, and the peripheral region is located along the inner walls of the plasma processing chamber near the top region.

63. (Previously Presented) A gas flow system as recited in claim 50, wherein the first output corresponds to a gas distribution plate having a pattern of holes, and wherein the second output corresponds to a gas ring having a series of holes substantially equidistant about the periphery of the gas ring, the gas distribution plate and gas ring cooperating to release the identical input gas in an azimuthally symmetric manner inside the plasma process chamber.

64. (Previously Presented) A gas flow system as recited in claim 50, wherein the first output is vacuum plate having a centrally located opening, and wherein the second output is a gas ring having a series of holes substantially equidistant about the periphery of the gas ring.

65. (Previously Presented) A gas flow system as recited in claim 64, wherein gas ring is located next to the vacuum plate.

66. (Previously Presented) A plasma processing apparatus as recited in claim 1 or 2, wherein the at least first and second gas outlets are configured to distribute the same single input gas in an azimuthially symmetric manner so as to improve process uniformity.

67. (Previously Presented) A gas flow system as recited in claim 50, wherein the input gas is not mixed and split after leaving the gas flow controller.

68. (Previously Presented) A gas flow system as recited in claim 50, wherein the input gas is delivered directly from the gas flow controller to the plurality of outlets.

69. (Previously Presented) A plasma etcher, comprising:

a process chamber within which an etching task is performed, the process chamber including a top wall that defines a top region of the process chamber and a side wall that defines a side region of the process chamber, the top region being disposed above a substrate to be etched, the side region being disposed to the side of substrate to be etched;

a gas flow system for delivering gas into the process chamber, the gas flow system comprising:

a single source of input gas, the input gas comprising a mixture of etchant source gases;

a gas flow controller for adjusting the amounts and splitting the input gas into at least a first portion and a remaining portion, each portion having the same mixture of etchant source gases because the gas is split; and

a plurality of gas conduits that directly couple the gas flow controller to a plurality of gas outlets located at different regions of the process chamber, a first gas conduit delivering the first portion of said input gas to a first gas outlet, a second gas conduit delivering the remaining portion of said input gas to a second gas outlet, the mixture of etchant source gases remaining the same while traveling through the first and second conduits from the gas flow controller to the first and second gas outlets such that the same mixture of etchant source gases is outputted by the first and second gas outlets into the process chamber, the first gas outlet outputting the first portion of input gas into the top region of the process chamber, the second gas outlet outputting the remaining portion of input gas into the side region of the process chamber,

wherein the gas flow controller is configured to adjust the gas flow rates of the first and remaining portions in order to control the distribution of neutral plasma components inside the process chamber thereby improving the results of the etching task that is being performed inside the process chamber.

70. (Previously Presented) A plasma etcher, comprising:

a process chamber within which a plasma is generated for etching a semiconductor substrate, the process chamber including an upper region and a lower region, the plasma including both charged and neutral components;

a gas input means configured to deliver a single input gas comprising a mixture of etchant source gases to different locations of the process chamber in order to control the distribution of neutral components inside the process chamber, the gas input means adjusting the time that the neutral components spend in different zones of the process chamber by varying the amount of input gas that is delivered to the different locations of the process chamber, the different zones of the process chamber including at least a hot zone where the input gases are excited, the different locations of the process chamber including at least the upper and lower regions of the process chamber.

71. (Previously Presented) The plasma etcher as recited in claim 70 wherein the input gas delivered to the upper region spends more time inside the process chamber than the input gas delivered to the lower region.

72. (Previously Presented) The plasma etcher as recited in claim 19 wherein the gas flow system is configured to vary the amounts of the first and remaining portions so as to affect the distribution of neutral gas components in different zones of the plasma processing chamber without affecting the composition of etchant source gases contained within the first and remaining portions, at least one of the zones being a hot zone where said input gas is excited inside the plasma processing chamber.

73. (Previously Presented) The gas flow system as recited in claim 50 wherein the first and remaining portions are controlled so as to adjust the distribution of neutral gas components inside the plasma process chamber.

74. (Previously Presented) The plasma processing system as recited in claim 1 further comprising:

an upper coil disposed above the process chamber and coupled to a radio frequency power source; and

a lower electrode disposed inside the process chamber and coupled to a radio frequency power source.

75. (Previously Presented) The plasma processing system as recited in claim 1 further comprising:

a pump configured to draw process gases and gaseous products from the plasma process chamber through a duct, wherein the duct is located closer to the peripheral region than the top region such that the first portion spends more time inside the process chamber than the remaining portion, and wherein the gas flow system varies the amounts of first and remaining portions in order to adjust the time neutral gas components spend inside the plasma processing chamber.

(9) EVIDENCE APPENDIX

None.

(10) RELATED PROCEEDINGS APPENDIX

None.